

FOOD AND FEEDING HABITS OF *Protopterus annectens* (OWEN)) IN GBEDIKERE LAKE, BASSA,  
KOGI STATE, NIGERIA.

Adeyemi, S.O<sup>1</sup> Bankole, N.O<sup>2</sup> and Adikwu, A.I<sup>1</sup>

<sup>1</sup>Department of Biological Sciences, Benue State University, Makurdi.

<sup>2</sup>Institute of Fresh Water Fisheries and Research, New Bussa, Niger State.

ABSTRACT

The food and feeding habits of *Protopterus annectens* in Gbedikere Lake, Bassa Local Government Area of Kogi State were studied. A total of sixty two fish samples were collected fortnightly from August to November 2008. The stomach content was analyzed using frequency of occurrence and numerical methods. Fish is omnivore feeding on other fish, sand/mud, insect parts, plant parts, crustaceans, cyst, worms, detritus and some unidentified items. The diversity of food substances found in the stomach and their occurrences in the juveniles and adults varied with the water bodies and season.

KEYWORDS: Lungfish, stomach content, feeding habit

INTRODUCTION

Fish must exploit food in aquatic environment and the adaptation for these is source of some morphological traits related to feeding. Understanding the relationship between body structures and fish diet could be important for predicting the diet of, how they feed and the mechanics of feeding (Wooten, 1992). Studies on stomach composition could provide useful information in positioning of the fishes in a food web in their environment and in formulating management strategy options in multi species fishery (Joseph and Djama, 1994). Pius and Benedicta (2002) reported the use of stomach content results to reduce intra and inter specific competition for ecological niche. The data on stomach composition of fish is vital in providing straight forward models of stomach content dynamics (Palmares *et al*, 1997).

*Protopterus annectens* commonly known as African lungfish is the only species of primitive family Lepidosirenidae found in West African fresh waters (Reed *et al*, 1967). Holden and Reed (1972) reported that the ancient fish did not form any significant part of commercial catches and that the flesh is tasty but many traditional taboos prevent the eating of the species.

The fish is characterized by a pair of lungs and strong solid teeth with powerful bony-ridge (Lagler *et al*, 1977). Reports of *P. annectens* include those of Reed *et. al.* (1967) and Holden and Reed (1972). The feeding adaptations (dentition, gill rakers and gut systems) of the fish have been described (Ipinjolu *et. al.*2004; Malami *et. al.*2004).

This study presents the result of food and feeding habits of *Protopterus annectens* from Gbedikere Lake, Bassa Local Government Area of Kogi State, Nigeria.

MATERIALS AND METHODS

Lake Gbedikere is a natural lake located between Latitudes 3°24<sup>0</sup> and Longitudes 5°14<sup>E</sup> and is about 10km to the East of Oguma the Head quarter of Bassa Local Government Area of Kogi State.

Water enters the Lake from tributaries that run from River Benue during rainy or flood season. When the season is over, the Lake separates out. The Lake is about 450m north of Gbedikere village. The water body covers about 400 – 450m and a depth of 10 – 14m deep, depending on the season.

The pond water is only used for fishing; consequently most of the settlers around the Lake are fishermen (Upper Benue River Basin Development Authority, 1985). The lake experience two seasonal periods; the rainy season starts in the month of May and last till October and is characterized by heavy down pour which sometimes have an extensive flood action. The dry season is from late October to April and is characterized by cold, dusty -dry

wind followed by intense heat. The Lake contains fish, other aquatic animals and some macrophytes such as wire grass (*Cyperus articulatus*) which are used for waving mats.

#### STUDY AREA

Lake Gbedikere is a natural lake located between Latitudes 3°24' and Longitudes 5°14'E and is about 10km to the East of Oguma the Head quarter of Bassa Local Government Area of Kogi State.

Water enters the Lake from tributaries that run from River Benue during rainy or flood season. When the season is over, the Lake separates out. The Lake is about 450m north of Gbedikere village. The water body covers about 400 – 450m and a depth of 10 – 14m deep, depending on the season.

The lake is used for fishing and other domestic activities; consequently most of the settlers around the Lake are fishermen (Upper Benue River Basin Development Authority, 1985). The lake experience two seasonal periods; the rainy season starts in the month of May and last till October and is characterized by heavy down pour which sometimes have an extensive flood action. The dry season is from late October to April and is characterized by cold, dusty -dry wind followed by intense heat.

#### COLLECTION OF SAMPLES

Samples of *P. annectens* were obtained from Oguma market in Bassa Local Government Area of Kogi State. The samples were purchase weekly from the fishermen from August to November 2008, and examined fresh, and transported into the Biological Sciences Laboratory of Kogi State University, Anyigba while those that could not be treated were preserved in a freezer until the next day. A total of sixty specimens (62) were examined. The total length (TL, cm) of each sample was measured.

The gut of the fish was removed by making a longitudinal incision along the mid ventral line form the mouth to the anus to expose the visceral organs. The gut was removed carefully by detaching it from other internal organs and fatty tissues. The gut length (GL) was then measured to the nearest cm on a graduated measuring board. The stomach was cut off from the gut and weighed on an electric top-loading balance (Sartorius) to obtain the stomach weight (SW). The stomachs were scored 0, 25, 50, 75 and 100% according to its fullness as described by Olatunde (1979).

#### IDENTIFICATION OF STOMACH CONTENTS

Each stomach was split open and the contents emptied into a Petri-dish. The contents were then observed under a monocular microscope. The food materials were identified with the aid of keys provided by Needham and Needham (1962) and Mellanby (1975).

#### ANALYSIS OF STOMACH CONTENTS

The stomach contents were analyzed by frequency of occurrence and numerical method as described by Hynes, (1950). Each food item was identified and number of stomachs in which each food occurred was counted and expressed as a percentage of stomach containing food. The method showed the proportion of individuals eating a particular food item in a species. The occurrence of each food item was expressed as a percentage of all stomach with food.

$$\text{That is, } P = (b/a) \times 100$$

Where, a = Total number of fish examined with food in the stomach; b = Number of fish containing a particular food item; P = Percentage of occurrence of each food item.

#### STATISTICAL ANALYSIS

The relationship between the fish TL and GL was computed using a linear regression model

$$GL = a + b \text{ TL}$$

Where GL is Gut length (cm); TL is Fish total length (cm); a is Constant; b is Exponent.

## RESULTS AND DISCUSSION

### Feeding Adaptations

The mouth of *P. annectens* is relatively small and terminal for feeding on smaller food substances in mid and open water, hence predator or prey on planktons (Reed *et. al*, 1967., Holden and Reed, 1972).

The teeth found in the species greatly and relatively to omnivorous food habits and its primitive compared to those found in the other species. The presence of razor-like bony ridge teeth indicates the ability of *P. annectens* to crack hard food substances like seeds and fruits. According to Reed *et. al*, (1967) *Protopterus* species have fusiform teeth massive ridges used for cracking shells and seeds.

### Stomach fullness

Table 1 shows the stomach fullness of samples analyzed. Twenty four percent (24.19%) of the sample had empty stomach while 75.8% had full stomach. This may suggest earlier stoning of the fish samples immediately after capture and active fishing methods employed. Similarly higher occurrence of non-empty stomach was due to good feeding strategy of species (Haroon, 1998) and food abundance in most part of the year (Fagade, 1978). The result of the higher fullness of stomach during the period of this work (August to November), more so, the availability of food material may be the reason for higher percentage of full stomach. This result supported the findings of Shinkafi *et. al*. (2001) who reported the higher percentage of stomach with food in July and August (Rainy season) when food is available.

Table 1: Analysis of stomach content of *Protopterus annectens* in Gbedikere Lake, Bassa Local Government Area of Kogi State.

Total No of stomach examined	Full stomach	Empty stomach
62	47 (75.81%)	15 (24.19%)

### Occurrence of Food Statistics

The frequency of occurrence and numerical method in the stomach of *P. annectens* is shown in Table 2. The major categories of food substances found in the stomach by % frequency of occurrence includes; plant parts (24.16%), fish part (6.12%) sand/mud (33.07%), crustaceans (8.57%), insect parts (8.13%), worms (0.22%), cyst (0.11%), detritus (6.12%) and unidentified items (13.47%). While numerical method had the following %; plant parts (32.42%), fish part (16.35%), sand/mud (32.21%), crustaceans (4.90%), insect parts (2.79%), worms (0.73%), cyst (0.15%), detritus (4.15%), unidentified items (6.30%). Analysis of variance shows that there was no significant difference ( $P>0.05$ ) in the stomach content based on the method used. This is inline of Oniye *et. al* (2006) that report insect, fish part, mollusks, fish and seeds in the stomach of the fish but contrary to that of Sadon *et'* al (1953), Reed *et. al*. (1967) and Teugels (1986) that reported to the fish to feed on frogs, mollusk, fish and seeds and concluded that the fish is a carnivore. This could be due to the difference between plants and animals in the aquatic environment in those locations. Fish species tend to have preferences for some items they consume as food Ofujekwu and Ejike (1992) reported that there is preference for a particular food organism in the diet of most species.

The results obtained suggest that the specie is an omnivore feeding more on plant and animal materials, sand grains and detrital matter. This deduction tallied with the findings of Reed *et. al*. (1967) and Holden and Reed, 1972) who report cyst, fish parts, benthic worms, insect and detrital matter as dominant food items in the stomach of ancient *Protopterus* specie. The result of this study shows that animal food material had higher occurrences during the study period. This may suggest diversify food habit of the specie because it possesses well equipped canal and bony-ridge teeth for manipulating animal substances (Malami *et.al*. 2004). The none empty stomach could be attributed to food abundance and good feeding habits.

## CONCLUSION

The result of feeding adaptive features of primitive *P. annectens* showed much modification of structural trait to suit omnivorous feeding habit. The stomach fullness during the period of study could be attributed to food

Table 2: Analysis of stomach content of *Protopterus annectens* using frequency of occurrence (%) and numerical method (%).

<i>Food items</i>	<i>% Frequency of occurrence</i>	<i>% Numerical method</i>
Plant parts	24.16	32.42
Fish parts	6.12	16.35
Sand/mud	33.07	32.21
Crustaceans	8.57	4.90
Insect parts	8.13	2.79
Worms	0.22	0.73
Cyst	0.11	0.15
Detritus	6.12	4.15
Unidentified items	13.47	6.30

abundance and good feeding habits. This result shows the need to stone the fish samples immediately after capture. The result on the stomach content analysis showed the food preference of *P. annectens* in natural ecosystem, which may be useful in satisfying their food requirement under pond management

The diversity of food substances identified in both aquatic and terrestrial origin depends on the availability as teleguided by season, size class and water body.

#### REFERENCES

- Fagade, S.O. (1978). The food and feeding habits of *Tilapia* species from the Lagos Lagoon. *Journal of Fish Biology*. 3:151-156.
- Needham, P.R. and J.G. Needham (1962). A guide to the study of freshwater biology. 5<sup>th</sup> Ed. Holden Day Inc. 108p.
- Haroon, A.S. (1998). Diet and feeding ecology of two size of *Barbodes gonionotus* and *Oreochromis* species in rice field in Bangladesh. NAGA, the ICLARM Quarterly pp. 13 – 18.
- Holden, M. and W. Reed (1972). *West African Fresh Water Fishes* West African Nature Book Longman Publications, London. 68p.
- Hynes, H.B.N. (1950). The food of freshwater Stickle backs (*Gasterosteus acculeatus* and *Pygoteus pungistis*) with review of methods used in studies of the food of fishes. *J. Animal Eco.* 19:36-58.
- Ipinjolu, J.K. G.Z. Malami, W.A., Hassan and I. Magawata (2004). Gut systems of some fresh water fish species in River Rima. Northern Nigeria. a paper presented at the 2004 Annual Conference of Zoological Society of Nigeria, held at Institute of Development Research, Ahmadu Bello University, Zaria.pp1-13
- Joseph, Y.J and T. Djama (1994). Food habits of two sciaenid fish species *Pseudotolithus* and *Pseudotolithus senegalensis* off Cameroon. *NAGA ICLARM Quaterly*.pp. 40-41.
- Lagler, K.F., Bardach, J.E., Miller, R.R and May Passino, D.R. (1977). *Ichthyology*. 2<sup>nd</sup> Edition. Wiley and Sons Inc. printed in USA.pp.129-163.
- Malami, G.Z., J.K. Ipinjolu, W.A. Hassan and I. Yaro (2004). Feeding Adaptations of ten fish species in River Rima. North Western Nigeria. A paper presented at the 2004 Annual Conference of Zoological society of Nigeria, held at Institute of Development Research, Ahmadu Bello University, Zaria.pp1-13.
- Mellanby, H. (1975). *Animal Life in Freshwater* 6<sup>th</sup> ed. A guide to Freshwater Invertebrates. Chapman and Hall, London. 323p.

Ofojekwu, P.C. and Ejike, C. (1992). Food composition and feeding habits of *Oreochromis niloticus* in Panyam Fish Farm, Nigeria. *Journal of Aquatic Science* 7:13 – 17.

Olatunde, A.A. (1979). The food and feeding habits of *Eutropics niloticus* (Ruppel), Family Schilbeidae (*Osteichthys:Siluriforms*) in Lake Kainji. *Hydrobiologia* 57: 197-203.

Oniye, J.S., Adebote, D.E., Usman, S.K. and Makpo, J.K. (2006). Some aspect of the Biology of *Protopterus annectens* in Jachi Dam near Katsina, Katsina State Nigeria. *J. Fish. Aquat. Sci.*, 1(2): 136 – 141, 2006.

Palmores, M.L.D., L.R. Garces, Q.P. Sia II and M.J.M., Vega (1997). Diet composition and daily ration estimates of selected trawl caught fishes in San Miguel bay, Philippines, Naga, the ICLARM Quarterly.pp 35 40.

Pius, M.O. and O.O. Benedicta (2002). Food and feeding inter-relationship. A preliminary indicator to the formulation of the feed of some Tilapiine fishes. *Tropical Journal of Animal Science* 5(1):35 -41.

Reed, W., J. Burchard, A.J. Hopson, J. Jennes, I. Yaro (1967). Fish and Fisheries of Northern Nigeria. 1<sup>st</sup> Ed. Ministry of Agriculture, Northern Nigeria. 226p.

Sandon H and Tayib, A.A (1953). The food of some common Nile fish. Sudan Notes and Records, 34: 205 – 229.

Shinkafi, B.A. and Ipinjolu, J.K. (2001). Food and feeding habits of catfish, *Synodontis clarias* (Linnaeus) in River Rima, Nigeria. *Journal of Agriculture and Environment*. 2(1):104-120.

Teugels G. (1986). A systematic revision of the African Species of the genus *clarias* (Pisces: Clariidae) Ann. Mus. R. Afr. Center. 247, 1 – 199.

Upper Benue River Basin Development Authority, (1985): Feasibility study of Lake Geriyo by Upper Benue River Basin Development Authority. Authority Information Manual.

Wooten, R.J (1992). Fish ecology. Blackies and Sons Ltd. New York

Received for Publication: 17/04/2009

Accepted for Publication: 15/05/2009

Corresponding Author (Present Address)

Adeyemi, S.O

Department of Biological Sciences, Kogi State University, Anyigba.

Email: sadeyemi2003@yahoo.com